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# Type of capture based fisheries and its related problems faced by the fishermen in Ambon Bay

W Waileruny<sup>1\*</sup>, S R Siahainenia<sup>1</sup>, D Noijs<sup>1</sup>, H S Lainsampatty<sup>2</sup> and D D P Matrutty<sup>1</sup>,

<sup>1</sup>Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Science, Pattimura University,

<sup>2</sup>Shipping Department, Faculty of Engineering, Pattimura University.

\*Email: wimwaileruny11@gmail.com

**Abstract.** Ambon Bay is one of the centers of economic activity held by the Ambon City community and its vicinity area. The fishing sector is one of the activities found in this area. The kind of fishing activity and its related problem faced by the fishermen of this area is the content of this study. This study was aimed to investigate the kind of fishing gear operated in this area and to identify problems faced by the fishermen in conducting their activity. Data were obtained from 91 fishermen fishing in this area with various types of fishing gear and conducted through interviews and field observation. Data obtained were then analyzed descriptively. Kind of fishing gears found to operate in Ambon Bay consists of gill net, hand line, beach seine, bottom longline, lift net, purse seine, and trap net. The common problem faced by the fishermen is plenty of floating debris, high turbidity caused by flooding. All these problems hampering the fishing activity that leads to a decline in fish production and fishermen's income. Another problem that occurs is the increase of fishing gear operated in the area with relatively a small fishing area apart from fish resources that already decrease compared to 15 – 20 years before. From field observation and interviews with the local fisher, it was found that fish production has declined up to 50%.

## 1. Introduction

The Ambon Bay water is physically divided into two sections: Inner Ambon Bay (IAB) and Outer Ambon Bay (AOB) separated by a small and shallow Galala basin. The Inner Ambon Bay is a relatively small, semi-enclosed area, shallow, and much influenced by rivers. The Outer Ambon Bay, on the other hand, is a wider area ( $\pm 143.5$  km<sup>2</sup>) with a deep-sea and connected directly with the Banda Sea. The Ambon Bay waters are a relatively productive area rich with a high diversity of fauna and flora. Three most productive ecosystem found in this area namely mangrove, coral reefs, and seagrasses that contribute significantly to fish resources [1, 2, 3, 4].

The Bay of Ambon that is surrounded by Ambon City, the capital of Maluku Province, is currently under heavy pressure as a result of substantial debris from the settlement area around the bay, government and private office, market activities, and other business centers. Data from the Cleaning and City Park Department of Ambon City for the year 2016/2017 shows that garbage produced by the Ambon City community amounted to 1,182.22 m<sup>3</sup> day<sup>-1</sup>. From that amount, only 400 m<sup>3</sup> (33.83%) can be discharged to the final discharging point per day. It was estimated that half of left off garbage ended up in the river and goes to the sea [5]. The intensity of garbage entering the sea increase during the rainy season (Eastern Monsoon), the time where fishing intensity is also high [6]. Many types of garbage were detected in Ambon Bay like plastic, rubber, wood, can, solid material, and so on [7, 8]. The presence of this marine debris highly troubling fishing activity that can cause a reduction in fish production.

The Ambon Bay waters have an important role for the local fishermen who live surrounding this area. The Ambon Bay used to be the main anchovy (*Stolephorus* spp.) live bait fishing ground for



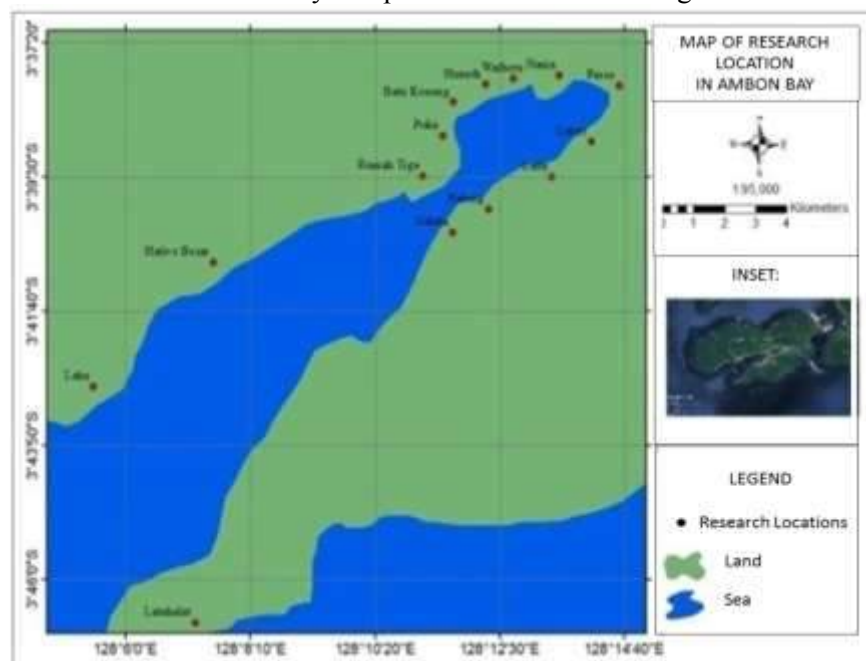
skipjack tuna pole-line fishery in the Ambon area [9, 10, 11, 12, 13]. There are some potential fishing ground found in Ambon Bay that become a targeted fishing ground for local fishermen [6, 12]. This suggests that there are several capture-based fisheries activity take place in this area.

What type of capture-based fisheries are currently operated in Ambon Bay and the problems faced by the fishermen is the focus of this study. The objectives of this study, therefore, to identify the type of fishing gear operated in Ambon bay and to investigate problems faced by the fishermen during the fishing operation. The result of this study is expected to be a source of information in enhancing capture-based fishery productivity of the local fishermen in Ambon Bay.

## 2. Methodology

The study was conducted between April to July 2019. Sampling station covering several villages surround Ambon Bay namely Galalla, Halong, Lateri, Lata Passo Nania, Waiheru, Hunut, Batu Koneng, Poka, Rumah Tiga, Hative Besar, Laha, and Latuhalat (Figure 1). Materials used in this study viz. digital camera, writing pads, and structure questionnaire sheets.

Primary data were collected through field observation and direct interviews with the 91 fishermen selected purposively from the study area. Secondary data were collected from journals, books, reports, and other documents related to the study. Data obtained were then analyzed descriptively. This kind of analysis is deliberately to describe the characteristics of one entity [14]. The descriptive analysis explain the variables obtained without any comparison or interconnecting variables statistically [15].



**Figure 1.** Research location showing sampling station

## 3. Results and Discussion

### 3.1. Captured based fisheries in Ambon Bay

Some of the fishing units permanently or seasonally operated in Ambon Bay consists of purse seine, lift net, beach seine, drift gill net, bottom gill net, bottom longline, handline, and trap net (Table 1). Based on the size of the vessel used, the fisheries in this area, in general, are categorized as small scale fisheries with small size fishing vessel, sometimes also called artisanal fishery [16, 17]. Almost all the fishing boat power is using the outboard engine both with a long and short shaft. There are also a few fishing boats that use human power.

Three fishing gears in Ambon Bay were found to operate for the whole year *i.e.* gill net, beach seine, and handline, while the other three fishing gears operated only at certain seasons/time are purse seine, lift net, and bottom longline. The fishing operation of these three fishing gears generally takes place at the eastern monsoon. During this time the waves around Ambon Island, especially on the southern and western side of Ambon, the area where these three fishing gears are operated, having high waves. The wave high could reach 3.65 m height as a result of the Australian monsoon that blows from the southeast with a speed of 1,289.68 m/sec [18].

**Table 1.** Type of capture based fishries operated in Ambon Bay

Fishing Gear Type	Boat size (m)			Engine Type	Number of crew (ind)	Main fishing product	Fishing Area
	Length	Height	Width				
Purse seine	15-17	3-3.5	1.5-1.75	- Outboard, short shatt	15-23	Small to medium pelagic fish	OAB
Lift net	9.5-11	0.80-1	0.85-1	- Outboard, short shaft	3-5	Small pelagig fish	OAB
Beach net	9.5-10	0.8-0.9	0.85-0.95	- No engine - Outbord, long shaft - Outboard, short shaft	12-20	Small pelagic fish	IAB
Drift gill net	7.5-9.5	0.7-0.8	0.65-0.85	- No engine - Outbord, long shat , - Outboard short shaft	1-3	Small and medium pelagic fish	IAB and OAB
Bottom gill net	6-9	0.6-0.8	0.5-0.8	- No engine, outboard long shaft	1-3	Small pelagic and demarsal fish	IAB and OAB
Bottom long-line	6-9	0.6-0.8	0.5-0.8	- No engine - Outboard long shaft	1-2	Demarsal fish	IAB and OAB
Trolling	6-9	0.6-0.8	0.5-0.8	- No engine - Outboard long shaft	1	Pelagic and demarsal fish	IAB and OAB
Trap net	7.5-8.5	0.7-0.8	0.65-0.8	- No engine - Outboard long shaft	1-2	Demarsal fish	IAB and OAB

Note: IAB: Inner Ambon Baay; OAB: Outer Ambon Bay

Wind speed in the Banda Sea and its surrounding area during eastern monsoon is about 5 – 20 nautical mile with a wave height of 2– 3 m above the western monsoon [19]. This condition causes the fishermen with a small fishing boat cannot operate in the southern and eastern side of Ambon Island which is directly face up the Banda Sea.

Even though there is no formal fishing ground territory between fishermen from Inner Ambon Bay (IAB) and Outer Ambon Bay (OAB), the fishermen already mapping the fishing ground by themselves. The fishermen from the coast OAB area of IAB tend to do fishing around the IAB area, whilst the fishermen from OAB tend to do fishing in OAB and the area around Ambon Island. The fishermen from IAB do not have purse seine and lift net that operated only at OAB. According to fishermen both from IAB and OAB, they tend to fish in their area since they have familiar with that area. If they move to other fishing grounds, they afraid that they will not be able to get any fish. Another reason is they afraid to cause a conflict in using the fishing ground.

Investment for each fishing gear varies significantly between the gears. All types of traditional fishing units have lower investment whereas fishing units of industrial-type have high investment costs. The fishing sectors with high investment cost gives high income and revenue and vice versa (Table 2). The fishing sector with the lowest investment cost is the fishing sector that has no engine use in their boat. Their fishing ground is close to the place they live in.

The fish harvested is grouped into fish with economic value (target fish) and non-economic value. The targeted fish is sold to the market, while the non-targeted fish is for their consumption. The small size fish product will also be used for family consumption.

**Table 2.** Cost, income, and revenue of each fishing gear in Ambon Bay

Gear Type	Investment (IDR Millino)	Operational Cost (IDR Million)	Income/trip (IDR Million)	Revenue/trip (IDR Milion)	Business Category
Handline	2.7 – 5.2	0 – 0.05	0 – 0.25	-0.05 – 0.15	Traditional
Bottom gill net	4.7 – 8.5	0.025 – 0.15	0 – 0.5	-0.15 – 0.35	Traditional
Purse seine	350 - 450	0.5 - > 7.5	0- > 10	-0.5 - > 3.5	Industry
Drif gill net	8 - 33	0.025 - 2	0 - 3	-0.15 - 1	Traditional
Beach seine	45 - 60	0.1 - > 3	0 - 5	-0.1 - 2	Industry
Bottom gill net	4 - 8	0 – 0.1	0 – 0.5	-0.1 – 0.4	Traditional
Lift net	95	-0.25 - > 5	0 - 5	-0.25 - 2	Industry
Trap net	5 – 8.5	0 – 0.75	0 - 5	0.75 - 3	Traditional

### 3.2. Problem faced by the fishermen

Based on interview and field observation, problems commonly faced by local fisher in doing their fishing activity in Ambon Bay as follow: 1) High number of garbage found in Ambon Bay; 2) High turbidity during a rainy season, and; 3) High number of fishing boat that operate

From all three common problems faced by the fishermen in Ambon Bay, garbage is considered as the major problem related to fishing. The presence of garbage disturbs the fishing activity that also increases the cost as a result of fishing gear and engine damage. Table 3 shows the summary of fishermen perception concerning the intensity scale of garbage number found in Ambon Bay for one year.

**Table 3.** The monthly presence of garbage and its scale of intensity in Ambon Bay

Month	Scale Number			No of respondent	Percentage		
	Lots	Medium	Few		Lots	Medium	Few
January	1	6	84	91	1.10	6.59	92.31
February	2	89	0	91	2.20	97.80	0.00
March	0	6	85	91	0.00	6.59	93.41
April	7	65	19	91	7.69	71.43	20.88
May	73	18	0	91	80.22	19.78	0.00
June	86	5	0	91	94.51	5.49	0.00
July	91	0	0	91	100.00	0.00	0.00
August	91	0	0	91	100.00	0.00	0.00
September	45	26	20	91	49.45	28.57	21.98
October	11	17	63	91	12.09	18.68	69.23
November	4	17	70	91	4.40	18.68	76.92
December	4	12	75	91	4.40	13.19	82.42

This table shows garbage problems varies between months with high intensity mostly happened from May to August, and this corresponding to the rainy season [7, 8]. For detail information on garbage status in Ambon Bay based on fishermen perception, see Table 3.

The presence of garbage in the sea creates various problems, one of which relates to fishing activity. This study shows that the problem varies between fishing gear used. In gill net and beach seine, for example, the problem arises from the garbage entangle at the net body. This problem causes difficulty in net hauling and some damage to the net. Table 4 summarizes the type of fishing gear, problem-related to that gear concerning garbage, the impact to the gear, and other multiplicative impacts.

During fishing operations, all the fishermen face the problem with different level of intensity arises from the garbage. Among all fishing gears operated, the gill net, beach seine, and purse seine are the gears that are most affected by garbage or marine debris. The mechanism of these gears is ensnaring fish encounter by the net. When the net encounter marine debris, automatically it entangle marine debris. The consequences of possibility arise from this are time-consuming to clear marine debris, gear damage, and decline in fish production. All other gears, their problems related to garbage, and the impact are summarized in Table 4.

**Tabel 4.** Problem faced by fishermen during fishing operation and their impact

Fishing Unit	Problem faced	Impact
Purse seine	The garbage entangles at body of the net and fishing boat propeler	<ul style="list-style-type: none"> <li>- waste of time</li> <li>- Production and income reduce or even no income obtained</li> <li>- The increase of maintenance costs</li> </ul>
Floating cage net	The garbage entangles at body of the net and fishing boat propeler	<ul style="list-style-type: none"> <li>- waste of time</li> <li>- Production and income reduce or even no income obtained</li> <li>- The increase of maintenance costs</li> </ul>
Beach seine	The garbage entangles at body of the net and fishing boat propeler	<ul style="list-style-type: none"> <li>- Waste of time</li> <li>- Engine maintenance cost increase</li> </ul>
Drifting gill net	The garbage entangles at body of the net and fishing boat propeler	<ul style="list-style-type: none"> <li>- waste of time</li> <li>- Production and income reduce or even no income obtained</li> <li>- The increase of maintenance costs</li> </ul>
Bottom gill net	The garbage entangles at body of the net and fishing boat propeler	<ul style="list-style-type: none"> <li>- waste of time</li> <li>- Production and income reduce or even no income obtained</li> <li>- The increase of maintenance costs</li> </ul>
Long-line	The garbage entangles to main rope and fishing boat propeller	<ul style="list-style-type: none"> <li>- Waste of time</li> <li>- Production and income reduce or even no income obtained</li> <li>- The increase of maintenance costs</li> </ul>
Hand-line	The garbage entangles to hook and boat propeller	<ul style="list-style-type: none"> <li>- Waste of time</li> <li>- Production and income reduce or even no income obtained</li> <li>- The increase of maintenance costs</li> </ul>
Trap	The garbage entangles to boat propeller	<ul style="list-style-type: none"> <li>- Coast of engine repairs increase</li> </ul>

Turbidity is another problem faced by local fisher of Ambon Bay especially during the wet season that brings particulate and suspended materials through the river to the sea. High turbidity disrupts

fishing operations especially for the handline with artificial bait. The targeted fishes could not find the bait easily, the bait color could have changed from its original color, The turbidity problem always coincides with the garbage problem, and both related to the wet season. The life span of seawater turbidity is ten days, whilst for the debris between 3-5 days.

The third problem faced by fishermen in Ambon Bay is the number of fishing units operated in this relatively small area with fish resources already limited if compared to 20 to 25 years before. The impact is low production as well as the income that decrease up to 50% prior to the era where the number of fishermen is still low. From an interview with the fishermen, all of them agree that current fish production is lower compared to 15 to 20 years ago.

#### 4. Conclusion

The bay of Ambon up to the present time is still a fishing ground for several fishing gears like purse seine, beach seine, drift gill net, bottom gill net, bottom long-line, trolling, lift net, and trap net. Some of the problems encountered by the fishermen in Ambon Bay are the bounty of marine debris in the bay, high turbidity especially during the wet season, and the high number of fishing units operated in this area. The number of marine debris (garbage) and turbidity disrupt the fishing activity which leads to time-consuming, increases in the cost of maintenance and repair and decrease in fish production and fishermen income per fishing unit.

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